REMARKS

1. Summary of the Office Action

In the non-final office action mailed on January 8, 2009, the Examiner rejected claims 1-4, 13-15, 28, 30, 35, and 45 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,139,496 (Chen). The Examiner rejected claims 5,11, 12, 19, and 23-26 under 35 U.S.C. § 103(a) as being unpatentable over Chen in view of U.S. Patent No. 6,544,177 (Robinson), rejected claims 6-9, 20, 22, and 27 as being unpatentable under 35 U.S.C. § 103(a) over Chen in view of U.S. Patent 6,488,625 (Randall), rejected claims 21 and 30 under 35 U.S.C. § 103(a) as being unpatentable over Chen in view of U.S. Patent No. 5,014,712 (O'Donnell), rejected claim 29 as being unpatentable under 35 U.S.C. § 103(a) over Chen in view of U.S. Patent No. 4,730,495 (Green), rejected claims 31-34, 40-44, and 48 under 35 U.S.C. § 103(a) as being unpatentable over Chen in view of U.S. Patent No. 6,251,073 (Imran), and rejected claims 18, 21, 22, and 46-55 as being unpatentable under 35 U.S.C. § 103(a) over Chen in view of U.S. Patent No. 6,245,017 (Hashimoto).

2. Status of the Claims

Presently pending are claims 1-9, 11-15, 18-35, and 40-56, of which claims 1, 46, and 49 are independent and the remaining claims are dependent. In this response, claims 1, 46, and 49 have been amended, and new claim 56 has been added.

3. Response to Rejections of Independent Claims 1, 46, and 49

A. Not only does Chen fail to disclose the invention of claim 1, Chen teaches away from the invention of claim 1.

As noted above, the Examiner rejected independent claim 1 under 35 U.S.C. §102(e) as being anticipated by Chen. In order to establish anticipation of a claimed invention, the reference must teach or suggest each and all of the elements of the claim. However, for at least the reasons provided below, Chen lacks various elements of the claim 1.

Claim 1 has been amended to clarify the invention. As amended claim 1 recites "a beamformer disposed within said housing… generating focused echo data; and an image processor disposed within said housing, said image processor receiving said focused echo data and generating an image corresponding to an image plane located below the plane of the display, wherein said

image represents a portion of said image plane that is in substantial alignment with said planar region of said display unit." Support for these amendments may be found generally throughout the specification and specifically on at least page 4, line 30 – page 5, line 2 (indicating image plane parallel to transducer plane), page 10, lines 11-12 (indicating display parallel to transducer), page 14, lines 8-13 (use of focused echo data) and at least in Figures 2A, 3A-3C, and 7.

Chen describes "an ultrasonic imaging system having a compact and easily manipulated probe assembly." Chen, col. 1, lines 8-10. Chen describes a "probe assembly 212 within a housing 225. These components are connected to the remainder of the system 100 by way of a flexible cable 216." The probe assembly includes "an operator interface 213 having a display 218 and data input means such as keys 215; an intermediate circuit 230 having first and second circuit boards 231, 232; and a sensor head 214 having a transducer array section 220 that includes a transducer array 221, flexible circuits 240, and an acoustic lens 224. The operator interface section 213 allows the operator to view a diagnostic image on the display 218..." Chen, col. 7, lines 52-58.

Claim 1 recites "a housing" with "a two-dimensional transducer array...a display unit...a beamformer... and an image processor" all "disposed within said housing". Applicant submits that Chen not only does not disclose these limitations, but teaches away from the invention of claim 1.

In discussing alternative approaches, Chen states that "**an attempt to integrate all of the functions of the diagnostic image system into a single portable unit, resul[ts] in a unit that is likely to be more complex and expensive than is necessary or desirable** ... [and] **forces the designer to resort to difficult and costly techniques to assure that all of the integrated components meet a diversity of opposing constraints**, such as low weight and mass, high reliability, low-cost, and ease of manipulation." Chen, col. 2, lines 57-60 and col. 3, lines 2-5 (emphasis added). Applicant therefore submits that at least the emphasized portions of Chen indicate Chen teaches away from the invention recited in claim 1.

In fact, the system of Chen does not contain "a beamformer disposed within said housing... generating focused echo data" as set forth in claim 1. The references to "acoustic beams" as relied upon by the Examiner in Chen, col. 9 lines 35-51, appear to refer to acoustic beams being transmitted to and from the transducer, and not to a beam former device that generates focused echo data. Rather, Chen describes the beam former 106 as being part of "control and signal

processing section 130" (e.g., see Chen, Fig. 1; col 6, lines 11-26), and that the "contemplated transducer probe assembly is connected to the control and signal processing circuit section 130 by way of the aforementioned signal interconnection means…",

As Chen not only fails to disclose all of the limitations of claim 1 but teaches away from the invention of claim 1, Applicants submit that claim 1 is not anticipated by Chen. Therefore, claim 1 is allowable over the cited art.

B. The Chen reference fails to disclose an "image plane that is in substantial alignment with said planar region of said display unit" as recited in claim 1.

Chen does not describe image planes that are substantially aligned with the display and transducer array as claimed. Specifically, Chen does not disclose generation or display of "an image corresponding to an image plane located below the plane of the display, wherein said image represents a portion of said image plane that is in substantial alignment with said planar region of said display unit" as recited in claim 1. Rather, Chen shows a B mode image as indicated by image 117 of object 115 in the view 114 on the display as shown in Chen, Figure 1. The image is therefore in a plane that is perpendicular to the transducer and display, and is not in substantial alignment with the planar region of the display. For at least this reason, Applicants submit that claim 1 is not anticipated by Chen and that claim 1 is allowable.

C. The Chen fails to disclose or suggest "a control to select the depth of the image plane" as recited in claim 2.

The Examiner rejected claims 2 and 3 under 35 U.S.C. § 102 as being unpatentable over Chen. However, Chen fails to disclose a controller used to adjust the depth of the image plane. Chen does describe " 'zoom', 'contrast', 'rotate', etc." functions, but these are not equivalent to adjusting image depth. Specifically, a "zoom" function merely magnifies a portion of an image, whereas selecting image depth provides a different image by processing echo data from a different region of the object being imaged. Applicants submit that the lack of a disclosure of a "depth" control is consistent within the context of Chen, as Chen deals with images perpendicular to the display and does not describe the generation of images where the "image plane [] is in substantial alignment with said planar region of said display unit".

D. The Chen/Hashimoto combination fails to disclose or suggest adjustment of image planes as recited in claim 46 or use of a collocated display unit, image processor, and two-dimensional transducer as recited in claim 49.

The Examiner rejected independent claims 46 and 49 under 35 U.S.C. § 103(a) as being unpatentable over Chen in view of Hashimoto. In response, Applicant has amended claim 46 to recite, *inter alia,* "providing a display unit disposed on said housing, said display unit displaying said C-mode image, wherein said display unit is adjustable at an angle relative to said housing, and wherein an image plane of said displayed image is based on said angle of said display unit." Support for this amendment may be found generally throughout the specification, and specifically on at least page 10, lines 5-17 of the specification and at least Figures 2A and 4.

Applicant submits claim 46 is allowable over the cited art as the Chen/Hashimoto combination does not disclose or suggest all of the limitations recited in amended claim 46. Chen has been discussed above with respect to claim 1. The Examiner admitted "Chen et al does not teach that the image is C-Mode." Office Action, p. 7.

To cure the admitted deficiency of Chen, the Examiner relied on Hashimoto. *See* Office Action, p. 7. Hashimoto discloses a "three-dimensional ultrasonic diagnostic apparatus [that] includes a two-dimensional array type of ultrasonic probe." Hashimoto, Abstract. In describing Figures 20A-20F, Hashimoto, describes "a method for setting a local region (3D-ROI) subjected to a 3D scan in the second and third scan modes." Hashimoto, col. 13, lines 52-53. Hashimoto states that "[t]o determine the 3D-ROI more readily, a C-mode image in the halfway position in the direction of depth within the 3D-ROI guide wire is displayed separately. The **C-mode plane can be set arbitrarily at any depth within the 3D-ROI guide wire according to the purpose**....When captured in the guiding C-mode image, the valve, an object of observation, will have been included in the 3D-ROI guide wire. Thus, if a C-mode plane is set in a 3D-ROI guide wire and the guide wire is moved in real time to a scan region using a C-mode image displayed in a separate area as a guide, the 3D-ROI including the valve captured in the C-mode image can be positioned efficiently and surely." Hashimoto, col. 13, line 57 – col. 14, line 5 (emphasis added).

Hashimoto states that "it is also possible to place the 3D-ROI in a region where a valve will probably be present and **shift automatically or manually the C-mode plane up or down.** In this case, at the time when the valve is captured well in the C-mode image, the stop position is specified

by switch control and then the 3D-ROI guide wire is shifted to conform to the C-mode plane." Hashimoto, col. 14, lines 7-13 (emphasis added).

Hashimoto also describes determining the 3D-ROI as follows: "First, the whole of a scan region is displayed in the form of a C-mode image. A valve which is an object of observation is captured, the stop position is designated by switch control, and a 3D-ROI guide wire of appropriate size then appears to conform to a C-mode plane. The optimum position of the 3D-ROI guide wire is determined by parallel shifting it in the C-mode plane and then its height and width are determined so that a desired 3D image display is obtained." Hashimoto, col. 14, lines 22-30.

To summarize, Hashimoto describes determining C-mode images and adjusting the depth of a plane for the C-mode image up or down. However, Hashimoto does not describe or suggest adjusting a C-mode image at an angle, or adjusting an image based on an angle of a display unit relative to a housing, much less "...displaying said C-mode image, wherein said display unit is adjustable at an angle relative to said housing, and wherein an image plane of said displayed image is based on said angle of said display unit" as recited in claim 46. Therefore, Hashimoto fails to cure the deficiencies of Chen to disclose or suggest all of the elements of amended claim 46. As claim 46 is not obvious over the cited art, Applicants submit claim 46 is allowable.

Amended claim 49 recites, *inter alia,* "generating a two-dimensional image via an image processor ...wherein the display unit, the image processor and the two-dimensional transducer are collocated within a housing." Support for these amendments may be found generally throughout the specification and specifically on at least page 14, lines 8-13 and at least in Figure 7.

As discussed above with respect to claim 1, Chen does not disclose the above-quoted collocation limitation; instead, Chen appears to teach away from collocation of these elements. Hashimoto fails to cure the deficiencies of Chen.

Hashimoto describes two embodiments. In "a 3D ultrasonic diagnostic apparatus according to a first embodiment of the present invention.... a 2D array ultrasonic probe 1 has a number of piezoelectric elements each formed on top and bottom with electrodes. The piezoelectric elements are arranged in a 2D array. To the ultrasonic probe 1 is connected an image gathering and processing unit 2, which has a 3D beam former 3 that performs on a transmitter/receiver section 5 delay control required to scan a 3D region within a human body under examination with ultrasound

through the probe 1 and a 2D beam former 4 that performs on the transmitter/receiver section 5 delay control required to scan a plane section within the 3D region with ultrasound through the probe 1." Hashimoto, col. 3, line 60 – col. 4, line 7.

Hashimoto also describes "a second embodiment.... This apparatus is composed of an ultrasonic probe 101, an apparatus body 112, a display unit 107, and a scan panel 111. The ultrasonic probe 101 used is of a 2D array type in which a number of piezoelectric elements adapted for inter-conversion between electric and acoustic signals are arranged in a matrix. The apparatus body 112 is constructed from a transmitter/receiver unit 102, a digital beam former switch unit 103, an image processing unit 113, a host CPU 110, and a display unit 109. The transmitter/receiver unit 102 comprises a transmission/reception switch 123 for switching between transmission and reception, a transmitter 121, and a preamplifier 122. The switch 123, at the time of transmitting ultrasound, connects the transmitter 121 to the ultrasonic probe 101 and, at the time of receiving echoes, connects the preamplifier 122 to the ultrasonic probe." Hashimoto, col. 6, lines 27-44.

However, Hashimoto does not teach or suggest "the display unit, the image processor and the two-dimensional transducer are collocated within a housing" as recited in claim 49. Rather, as quoted above, Hashimoto appears to describe probes with transducer arrays that can be attached to an apparatus body with an image processing unit and a display unit. Therefore, Hashimoto fails to cure the deficiencies of Chen to disclose or suggest all of the elements of amended claim 49. As claim 49 is not obvious over the cited art, Applicants submit claim 49 is allowable.

4. Response to Rejections to Dependent Claims

Each of the pending dependent claims 2-15, 18-35, 40-45, 47-48, and 50-55 ultimately depends from independent claim 1, independent claim 46, or independent claim 49. As shown above, each of the independent claims is allowable. Therefore, each of the dependent claims is allowable for at least the reason that each dependent claim ultimately depends from an allowable base claim. Thus, Applicants respectfully request the Examiner withdraw the rejections under 35 U.S.C. §§ 102 and 103 for claims 1-15, 18-35, and 40-55.

5. Conclusion

For these reasons, Applicants respectfully request favorable reconsideration and allowance of the pending claims. Should the Examiner wish to discuss this case, the Examiner is invited to call the undersigned at (312) 913-3305.

Respectfully submitted,

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